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DATE: October 28, 1994

SUBJECT: RECOMMENDED OUTLINE FOR USING U. S.
ENVIRONMENTAL PROTECTION AGENCY REGION IX
PRELIMINARY REMEDIATION GOALS IN SCREENING
RISK ASSESSMENTS AT MILITARY FACILITIES

Outcome: 02 PCA: 14765 Site: 914600-45

BACKGROUND

Anthony Landis of Office of Military Facilities (OMF) requested that Office of Scientific Affairs (OSA) provide guidance on the use of Preliminary Remediation Goals (PRGs) published by U. S. Environmental Protection Agency (EPA), Region IX for the purpose of screening sites or prioritizing sites for remedial action at military facilities. This request is a follow-up to our memorandum to you of August 26, 1994, in which Human and Ecological Risk Assessment Section (HERS) outlined three acceptable approaches to performing risk assessment at open military facilities.

HERS continues to recommend that the *Preliminary Endangerment Assessment (PEA) Guidance Manual* (Department of Toxic Substances Control (DTSC), 1994) be used to screen sites for "no further action", based upon the potential for adverse effects on human health and the environment. We understand that military facilities in California have expressed interest in



using U. S. EPA Region IX PRGs. In the past, HERS has expressed concern that the U. S. EPA Region IX PRGs omit important exposure pathways and other components specified in the PEA. Thus, we have often stated that PRGs were not appropriate for screening sites.

U. S. EPA Region IX published new PRGs on August 1, 1994 which differ from earlier versions. The August 1, 1994 PRGs from U. S. EPA Region IX were modified to consider more pathways and factors. The derivation of the "Soil PRGs" shown in the August 1, 1994 list from U. S. EPA Region IX now more closely conforms to the PEA process. As explained below in **Section C**, "Cal Modified" PRGs are provided for six chemicals in the August 1 PRG list which differ by more than four fold from values calculated using the PEA process. Nevertheless, using this most recent August 1 list of PRGs requires a complete guidance context, such as that provided in the PEA.

In our previous memorandum to you of August 26, 1994, HERS outlined three acceptable approaches to performing risk assessment at open and closing military facilities:

1. Use the 1994 PEA process;
2. Use the August 1, 1994 PRGs from U. S. EPA Region IX (or subsequent lists), provided a protocol is submitted and accepted specifying how these PRGs are to be used; or
3. Perform a complete multipathway risk assessment using DTSC and U. S. EPA guidance for risk assessment.

The purpose of this memorandum is to provide OMF with a framework of important elements to be included in the protocol for Number 2 above. What we provide below is largely the logic of the PEA process to supplement the August 1, 1994 PRGs from U. S. EPA Region IX.

REQUIRED ELEMENTS FOR USING U. S. EPA REGION IX PRGs

The following are elements which must be addressed in any work plan or protocol which makes use of the August 1, 1994 U. S. EPA Region IX PRGs, or subsequent lists. All of these elements must be addressed.

A. Land Use

In general, HERS strongly recommends that an unrestricted

land use scenario, similar to a residential scenario, be used for site screening, unless a recorded deed restriction prevents such land use. This recommendation is based on our experience that screening evaluations are conducted to determine whether a finding of "no further action" is warranted. We make this recommendation for screening risk assessments at all military facilities, both active and closing.

In nearly all cases, the unrestricted (residential like) setting provides the greatest potential exposures to contaminants. Therefore, sites found to have acceptable risk for unrestricted land use will also have acceptable risks for other uses, such as industrial. However, sites found acceptable for industrial use might not be acceptable for other uses. For military facilities which are closing or have closed, HERS recommends that the unrestricted setting be used for site screening. We assume that reuse of these facilities will result in a change of ownership and land use. The unrestricted scenario is the most appropriate for screening sites at open facilities as well, because this health-conservative analysis provides the risk manager with enough information to approve "no further action" or to require additional investigation. Use of an unrestricted exposure scenario in no way obligates the risk manager to clean up to this level. If ultimately industrial use is seen to be the probable land use, then the site can be remediated to this level. The unrestricted scenario can then provide documentation to restrict land use to industrial.

PRGs for an industrial setting are provided in the August 1, 1994 publication from U. S. EPA Region IX. The protocol should clearly document the basis for assuming unrestricted land use (such as residential) will not occur in the future; the results of screening against residential PRGs should be included to document the need for any restrictions on future land use.

The Project Manager should be aware that several exposure pathways are not included in U. S. EPA Region IX's calculation of Industrial PRGs. The excluded pathways are:

1. All uses of surface and groundwater;
2. Exposure to soil gas which infiltrates indoor air;

3. Exposure to surface and groundwater contaminated by soil leachate; and
4. Inhalation of particulates from trucks and heavy equipment.

The protocol must address the rationale for eliminating each of these pathways for use of the Industrial PRGs to be acceptable.

B. Background, Detection Limits, Exposure Point Concentrations, and Key Chemical Groups

Inorganic constituents present at levels above the PRGs but at or below site background may be eliminated from the screening procedure. However, the fact that they are present above the PRGs should be noted in the assessment, along with the levels at which they were found. Preparers of protocols should consult with the DTSC Project Manager on the adequacy and representativeness of background sampling.

The protocol must include evaluation of the adequacy of the method detection limits (e.g., can the media-specific PRGs be detected?).

For site related chemicals remaining after comparison against background, the choice of the exposure point concentration should be specified in the protocol as either the maximum concentration observed or the 95 percent upper confidence limit on the arithmetic mean concentration (95 percent UCL). The 95 percent UCL may be used only with the approval of the DTSC Project Manager.

Several chemical groups occur repeatedly as "risk drivers" for military sites. The protocol should include how the following chemical groups will be assessed:

1. Polycyclic aromatic hydrocarbons (PAHs),
2. Polychlorinated biphenyls (PCBs),
3. Polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs),
4. DDT and its congeners DDE and DDD; and
5. Hexavalent chromium.

Analytical results for total petroleum hydrocarbons (TPH) may not be used at any level of risk assessment. Instead, the principal toxic constituents must be quantified and their concentrations compared against the August 1, 1994 PRGs from U. S. EPA Region IX. The principal toxic constituents of hydrocarbon fuels are certain metals benzene, toluene, ethylbenzene, xylene(s), and PAHs.

C. California Modified PRGs

With the exception of nine substances (the six compounds listed immediately below, two PAHs listed in a following paragraph and lead, described on the next page), the August 1, 1994 PRGs from U. S. EPA Region IX now differ by no more than four-fold from values calculated using the PEA process and Cal/EPA cancer potency factors. U. S. EPA Region IX has published "CAL-Modified PRGs" for the following six chemicals in its August 1, 1994 PRGs:

1. Cadmium,
2. Hexavalent chromium,
3. 1,2-dibromo-3-chloropropane (DBCP),
4. Nickel and compounds,
5. Benzo(a)pyrene (in water only), and
6. Tetrachloroethene (PCE).

These "CAL-Modified PRGs" should be used when screening sites at Federal facilities in California.

In the August 1, 1994 Region IX list, PRGs for two additional substances, chrysene and benzo(k)fluoranthene differ by more than a factor of four as calculated by the PEA process and by Region IX. CAL-Modified PRGs for chrysene and benzo(k)fluoranthene (both are PAHs) are given in Appendix A-1, to be included with the Region IX PRG list. *These should be used when screening sites at Federal facilities in California.* It is expected that the CAL-modified PRGs for these two chemicals will be added to the body of the Region IX PRG list at its next iteration. Also contained in Appendix A-1 are PRGs for all Carcinogenic PAHs for which Region IX has calculated a PRG.

Appendix A-2 contains Provisional PRGs for all PAHs that

have Cal/EPA Potency Slopes or Potency Equivalency Factors available, but for which Region IX has not calculated a PRG. These Provisional PRGs were derived by OSA using Cal/EPA Potency Equivalency or Cancer Slope Factors and U.S. EPA Region IX PRG methodology. These Provisional PRGs are available for screening sites at Federal Facilities in California upon consultation with OSA and Region IX toxicologists.

The PRG for naphthalene is currently under discussion with Region IX. Please consult with Michael Wade at OSA regarding a PRG for this substance. A finalized PRG for naphthalene should be available by the next iteration of the Region IX PRG list.

The U. S. EPA Region IX soil PRG of 400 parts per million (ppm) for inorganic lead under residential scenario, does not conform to DTSC policy. The PEA (1994) screening level of 130 ppm inorganic lead in soil should be used at Federal facilities in California.

D. Impacts to Water

The August 1, 1994 publication from U. S. EPA Region IX also contains "Tap Water PRGs". These "Tap Water PRGs" can only be used if an exposure point concentration for the contaminant in groundwater or surface water is available or can be estimated. It is important to understand that the "Soil PRGs" are not calculated to include the potential for the contaminant to move to groundwater or surface water. Neither do they assess the likelihood that groundwater or surface water has been impacted by past releases. Such a determination requires the preparer of the protocol and the DTSC Project Manager to consider the complexities of geology and soil characteristics, disposal history, and chemical fate and transport to make an informed determination based on professional judgment.

The protocol should describe how impacts to groundwater and surface waters will be assessed, considering not only past releases, which could have resulted in existing impacts to groundwater, but also the potential for additional releases which may result in future impacts.

Preparers of protocols must gain the concurrence of the DTSC Project Manager that impacts to groundwater and surface waters are adequately addressed. This approval should be given prior to any calculation of risks/hazards to human

health. If site-specific information is insufficient to judge the potential impact of contaminants on surface water and groundwater, then the calculation of risks/hazards cannot proceed. Estimates of risks/hazards are not useful if they do not reflect the true risk from site contaminants. If it has been determined that no threat exists now or in the future to surface water or groundwater, and if DTSC staff concur with this determination, then the protocol must contain the rationale for eliminating this pathway.

In some instances, information may be limited on threats to surface water and groundwater, but available data do not fully represent the nature and extent of the contamination in water. In such an instance, the "Tap Water PRGs" from U. S. EPA Region IX's August 1, 1994 document can be used to compare against concentrations in waters at the site; however, such comparisons must be accompanied by a qualifying statement indicating that the risk estimates from the water pathway may be underestimated.

The "Tap Water PRGs" are for screening levels for human health only; protection of aquatic organisms was not considered in their derivations. It cannot be assumed that levels protective of humans are protective of aquatic organisms and wildlife.

E. Excluded Pathways

Certain pathways were excluded in the derivation of the August 1, 1994 PRGs from U. S. EPA Region IX. The protocol must provide a rationale for why these pathways can be excluded at the site in question.

1. **Water:** The August 1, 1994 "Tap Water PRGs" from U. S. EPA do not consider dermal absorption from bathing/showering for groundwater and surface water exposures. The "Tap Water PRGs" include neither ingestion of water while swimming nor transfer of contaminants in the water column to aquatic organisms or terrestrial plants, with subsequent ingestion by humans. This is not consistent with the PEA (1994), which does add this route of exposure. If this pathway is expected to result in a significant exposure, HERS should be contacted.
2. **Soil:** The "Soil PRGs" include neither inhalation of soil gases which infiltrate indoor air nor ingestion of contaminants by humans via uptake by plants (home-grown

fruits and vegetables) or animals (milk, meat, eggs). If these pathways are expected to result in a significant exposure, HERS should be contacted.

F. Air Models

Several issues regarding air are covered in the PEA but not in the August 1, 1994 PRGs from U. S. EPA Region IX. The following limitations should be noted when using these PRGs:

1. **Volatile Compounds:** The models used to calculate the "Ambient Air PRGs" and "Soil PRGs" do not represent the enhanced volatilization of compounds which can occur in the presence of landfill gases such as methane. For example, when solid waste is disposed along with hazardous wastes, the generation of methane formed from the decomposition of the solid waste can increase the emission rate of other volatile compounds. The air model for volatile compounds is based on the soil as the only source; shallow groundwater which contains volatile compounds may be an additional source to the ambient air. The August 1, 1994 PRGs from U. S. EPA Region IX were derived with a volatile emissions model using an industrial area of 2025 m², while the PEA manual used an area of 484 m² for a residential setting. This may result in different air concentrations from the two methods.

Sometimes calculation of the "Soil PRG" resulted in a concentration which would exceed the theoretical saturation concentration in soil; in these cases U. S. EPA Region IX notes the "Soil PRG" as a "max" or "sat". This means that the "Soil PRG" is based not on risk or hazard but on the maximum soil concentration that is predicted to be absorbed onto the soil (without free product present). Above this predicted saturation concentration, the air model employed by U. S. EPA Region IX is no longer applicable, and the potential presence of free product implies a predicted threat to surface or groundwater. The protocol should indicate how exceedances of the saturation concentration will be dealt with.

2. **Fugitive Dusts:** The dust model used in the "Soil PRGs" and "Ambient Air PRGs" is a rapid assessment method which assumes a continuous and constant source for emissions. If the source at the site is actually small

and will deplete over the time frame of the exposure, then risks/hazards will be overestimated.

G. Additivity of Risk and Hazards

For each site-related chemical, concentrations in soil, air and water (if all these pathways are relevant) should be divided by the corresponding "Soil PRG", "Tap Water PRG", or "Ambient Air PRG"; these ratios must then be added across media. This summed ratio provides an estimate of the total risk or hazard for that compound in multiple media. In addition, the risk or hazard for multiple compounds at the site must also be accounted for according to the following:

1. **Compounds with Non-threshold Effects (Carcinogens):** Chemicals whose PRGs are based on carcinogenic effects are designated with "ca" in the August 1, 1994 PRGs from U. S. EPA Region IX. All concentrations of carcinogens are thought to be associated with at least some risk, i.e., no threshold. Section 2.4 of the August 1, 1994 PRGs from U. S. EPA Region IX suggests adding the risk ratios together for multiple carcinogens to provide an estimate of risk for the total site. The magnitude of the risk will be the sum of the ratios times 10^{-6} . This provision must be included in the protocol.
2. **Threshold Compounds (Non-carcinogens):** Chemicals whose PRGs are designated with "nc" in the August 1, 1994 PRGs from U. S. EPA Region IX are thought to exert toxic effects which display a threshold, i.e., a level below which no toxicity is expected. Section 2.4 of the August 1, 1994 PRGs from U. S. EPA Region IX suggests that hazard ratios (non-cancer endpoints) be summed to provide a hazard index. U. S. EPA Region IX does not provide PRGs for the threshold effects of carcinogens.

If the summed hazard index is greater than one, then the hazard index may be recalculated for chemicals which have the same toxic manifestation or which affect the same target organ. The protocol must provide a discussion of which chemicals will be grouped, if any, and provide a rationale for the grouping.

H. Ecological Assessment

The August 1, 1994 PRGs from U. S. EPA Region IX only apply to human receptors. It cannot be assumed that levels protective of humans will also protect ecological receptors. The protocol must describe how the ecological assessment will be conducted. The protocol must address the potential for impacts to ecological receptors within the site boundary, as well as the potential for impacts off-site due to movement of contaminants (e.g., conveyance off-site via a storm drainage system) or intermedin transfers (e.g., food-chain transfers to animals residing off-site but using the site as a forage area). HERS recommends a screening level ecological evaluation, either one which follows the guidance outlined in Section 2.6 of the PEA, or one which follows the recently published *Draft Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Parts A and B: Scoping Assessment* (DTSC, September 1994).

SUMMARY

HERS provides in this memorandum a framework similar to the PEA within which the August 1, 1994 PRGs from U. S. EPA Region IX may be used for screening sites at military bases in California. If it is determined that a full-scale baseline risk assessment is needed, chemicals cannot be eliminated because they are below PRG or PEA levels due to the need to add risk and hazard for all chemicals.

We emphasize to OMF that sites which fail this screening process require further investigation, and do not necessarily require removal actions. Such further investigation might be very limited in scope. For example, further characterization of certain compounds may be needed, such as speciation for hexavalent chromium, or further refinement of the risk estimates could be conducted, such as use of a different air model based on site characteristics.

If you have any questions on this memorandum, please contact HERS liaison for Federal facilities, Dr. Michael Wade, at (916) 327-2496 (CALNET 467-2496).

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October 28, 1994
Page 11

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REFERENCES

1. Department of Toxic Substances Control. January 1994. Preliminary Endangerment Assessment Guidance Manual. State of California, Environmental Protection Agency. Sacramento, California.
2. Department of Toxic Substances Control. September 1994. Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part B: Scoping Assessment. Draft guidance for review and comment. State of California, Environmental Protection Agency, Office of Scientific Affairs, Human and Ecological Risk Section. Sacramento, California.
3. United States Environmental Protection Agency, Region IX. August 1, 1994. Memorandum from Stanford J. Smucker, Ph.D., Regional Toxicologist, Technical Support Section, Subject: Region IX Preliminary Remediation Goals (PRGs) Second Half 1994.

APPENDIX A-1
SOIL PRGs FOR CARCINOGENIC PAHs

<u>COMPOUND</u>	<u>CAL/EPA POTENCY EQUIVALANCY FACTOR</u>	<u>U.S. EPA REGION IX RESIDENTIAL SOIL PRG (ppm)</u>
benzo(a)pyrene	1.0 (index compound)	6.1 E-02
dibenz(a,h)anthracene	0.4 ^a	6.1 E-02
benzo(a)anthracene	0.1	6.1 E-01
benzo(b)fluoranthene	0.1	6.1 E-01
✓benzo(k)fluoranthene	0.1	6.1 E-01 ^b
indeno(1,2,3-c,d)pyrene	0.1	6.1 E-01
✓chrysene	0.01	6.1 E+00 ^b

^aToxicity Equivalency Factor calculated from CAL/EPA Cancer Slope Factor of 11.5 (mg/kg-day)⁻¹ for benzo(a)pyrene and 4.1 (mg/kg-day)⁻¹ for dibenz(a,h)anthracene.

^bCal-Modified PRGs based on Cal/EPA Potency Equivalency Factors and U.S. EPA Region IX PRG methodology.

Appendix A-2
CARCINOGENIC PAHs WITHOUT U.S. EPA REGION IX PRGs

<u>COMPOUND</u>	<u>CAL/EPA POTENCY EQUIVALENCY FACTOR OR CANCER SLOPE FACTOR</u>	<u>PROVISIONAL SOIL PRG^{a,b}</u>
benzo(j) fluoranthene	0.1	6.1 E-01
dibenz(a,j) acridine	0.1	6.1 E-01
dibenz(a,h) acridine	0.1	6.1 E-01
7H-dibenzo(c,g) carbazole	1.0	6.1 E-02
dibenzo(a,e) pyrene	1.0	6.1 E-02
dibenzo(a,h) pyrene	10.0	6.1 E-03
dibenzo(a,i) pyrene	10.0	6.1 E-03
dibenzo(a,l) pyrene	10.0	6.1 E-03
5-methylchrysene	1.0	6.1 E-02
1-nitropyrene	0.1	6.1 E-01
4-nitropyrene	0.1	6.1 E-01
1,6-dinitropyrene	10.0	6.1 E-03
1,8-dinitropyrene	1.0	6.1 E-02
6-nitrochrysene	10.0	6.1 E-03
2-nitrofluorene	0.01	6.1 E+00
7,12-dimethylbenzanthracene	(250) ^c	2.8 E-03
3-methylcholanthrene	(22)	3.2 E-02
5-nitroacenaphthene	(0.13)	5.4 E+00

^aDerived by OSA using CAL/EPA Potency Equivalency Factors or Cancer Slope Factors and U.S. EPA Region IX PRG Methodology.

^bPlease contact OSA should you have a question regarding PRGs for these compounds.

^cParentheses signify Cancer Potency Slopes given in units of (mg/kg-day)⁻¹.